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DESIGN CONSIDERATIONS OF INDIAN BREAD MAKING TOOLS – A REVIEW

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ABSTRACT

The common tools used in Indian bread making are the Rolling board and Rolling pin. Indian breads are rolled out on a rolling board with the help of a rolling pin. The diet consciousness of people in the present days has lead to an increase in Indian bread consumption irrespective of region. In bread making process, the bread gets attached to the rolling pin and the rolling board. To avoid sticking of dough, the flour is been added which changes the texture of the dough. Apart from this the rolling pin and the rolling board were in lack in design issues like instability of the board, improper grip of handle of rolling pin etc. which causes drudgery to the user. Dough sticking to the pin has the disadvantages. In order to overcome the disadvantages a proper well designed tools must be considered. So the present study was carried out to study the design considerations of Indian Bread Making Tools. Designing the tool considering the ergonomic aspects create a working task in an efficient way. Efficiency of work performance depends on different limits of users and tools. Such different limits may be his/her anthropometric, physiological, biomechanical and psychological aspects, which must be considered for a safe and effective tool design. In designing any user based tool the dimensions of the human hand has to be given due importance.

KEYWORDS: Indian Breads, Rolling Pin, Rolling Board, Rolling Equipment & Tool Design

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Review Article

INTRODUCTION

The tools used making Indian brads are the Rolling board and Rolling pin, which are available in a variety of materials and sizes. Indian breads are rolled out on a rolling board with the help of a rolling pin. Due to the diet consciousness, the consumption of Indian breads are increasing which is making the demand in the availability of rolling pins and rolling boards productivity. In South Asia, along with the rolling board rolling pin is used, as the rolling pin flattens the dough on the rolling board. The dough of chapattis is rolled on chakla with the help of the belan (Manohar and Rao, 2005). A rolling pin which is also known as belan is a cylindrical food preparation tool used to shape and flatten dough (Reginald, 2011). A rolling board is the flat circular base board which acts as a base (Heloise, 1963) for placing of dough and the dough been pressed on it and made into a circular shape crust or roti with the help of a cylindrical rolling pin. Rolling boards are available in variety of sizes, shapes and materials.

Thomson (1978) in the study "Rolling pin construction" mentioned that the rolling of the dough gets attached to the rolling pin and the rolling board. To avoid sticking of dough, the flour is been added which changes the texture of the dough. Apart from this the rolling pin and the rolling board were in lack in design issues like instability of the board, improper grip of handle of rolling pin etc. which causes drudgery to the user. Dough

sticking to the pin has the following disadvantages.

- It is less efficient because it takes more time and energy consumption to complete the task
- The addition of flour to the pin and the board including dough, changes the dough quality and the texture as the flour avoids the sticking of dough to other surfaces.
- As and when the flour is added to avoid the stickiness of dough, the flour makes the dough uneven flattering which makes the inappropriate baking temperature of the dough as some part will be crisper than the others.
- So, there is a need to consider the designing issues for bread making tools and accordingly the review was collected.

DESIGN ASPECTS OF BREAD MAKING TOOLS:

Bread making tools are daily part of human life as everyday human is using the tool foe making breads to maintain diet for physical fitness and good health. Sperling et al. (1993) formulated the guidelines for the Indian bread making tools in relation to the work worker and work environment of hand tool. The guideline formulated has four design considerations which explains about the design aspects of hand tool.

Designing Aspects of Rolling Pin

Bernard (1921) developed a multipurpose rolling pin. This pin consists of a fabric covered surface. One of the handle of the rolling pin is detachable, as the rolling pin can also be used as the masher and for other purposes in the kitchen. Among the handles of the developed rolling pin, one of the handle is in the form of knife by which the dough can be made into pieces before rolling. There is a socket type of provision to insert the knife into the rolling pin and forms as a handle for the pin.

Glen (1966) had developed and improved the twin rolling pin. It was constructed with the two edges on the either sides which is called as frame. For the frame the two rollers parallel to each other were been fitted with the shaft and these rollers are rotatable. In roti making process, the dough gets attached to the roller due to its sticky nature, but whereas in this twin roller pin system the other roller helps in maintaining not to get sticked. If the dough gets sticked to the first roller, the second roller makes and pushes the dough downwards to the base. In this process, often the dough which is flattened gets teared off and wrapps off. This twin roller can also be used by the handicapped as the pressure of the hand on the pin is less required comparatively to the normal rolling pin. One hand can be used to roll the dough where the rollers make the dough flat into an even thichkness. This twin roller completes the task faster compared to normal one as it has beed provided with two rollers and also reduces the effort of the user.

Brandes and Guenther (19 77) disclosed a rolling pin which can roll the dough into different thicknesses. The rolling pin consists of a rotatable gauge on the roller rod which makes the crust or dough rolled into the different thicknesses required by the user. The pressure on the handles will not be much imposed as it is a rotatable tool. Physical elements of the tool and ergonomical aspects were considered to carry out the task efficiently.

Thomson (1978) invented a pastry roller, a new device which makes the rolling of dough smooth, even at regular intervals. The body of the pin is elongated with long cylindrical terete body where the edges of the pins diameter is decreased comparatively to the center line of the rolling pin. As the rolling used, the pressure of hands falls on the so called serrated handles of the pin, the center part diameter of the pin makes the rolling to roll the dough evenly as the center of

gravity is considered in the pin as the downward pressure is been loaded on the rolling pin.

Gibran and Firth (2001) developed a rolling pin with the center roller body and the protrusion of the handles developed wisely with a proper grip of the user. The handles were been protruded in an inverted L-shape providing a convex curved area of the handles on the either side of the roller. This form of handles give firm grip to the fingers and the wrist of the user making comfortable reducing the stress and fatigue of the user. The posture of the wrist along with handles provided make the user to perform the activity easily.

Durr (2002) identified that the silicone material can be used on the surfaces of the rolling pin such as plastic, stone, wood, Teflon, etc. He developed a rolling pin of the silicone material jacketed into the roller made the dough unstick to the roller due to which addition of flour to the dough can also be avoided.

Davis (2006) found a clip, spacer disk system which is been attached to the ends of the cylindrical body of the rolling pin, for this rolling pin the handles were provided taking the central axis of the cylindrical body which provided an equal pressure on the body of the pin along with the handles on the dough placed on the board. The guide disk members were provided and can be fitted accordingly to the central body as the required thickness of the chapatti can be made. This can be accepted as a new invention and can be adapted to any situation required for any newer models invented. As it is equal to the design of the normal rolling pin provided with the central axial handles of the cylindrical axis of the pin make the dough rolled. The clip spacer disk system help in rolling the dough into the desired thickness by the user based on the variety required.

Orlady (2007) had developed a rolling pin of metal system. This rolling pin had a special removable hollow core in the cylinder of the pin, where the cellulose gel material in the core would be inserted and the core is fitted to the cylinder which makes the dough and the pin frozen cold for a longer period. The rolling pin system has more than one core to assure the freezing of the pin and dough.

Dua et al (2010) developed or patented a rolling pin with the provision of hollow or solid central core in the cylinder body of the rolling pin. When the core is hollow the series of disks is placed on the central and are provided along with the plates towards the length of the body. The roller shaft is passed across or the dough, the series of the disks forming a cylindrical peripheral shell. A jacket with silicone material is provided to the peripheral shell forming an internal diameter making the dough unsticky and rolled into an even thickness.

Designing Aspects of Rolling Board

William (1899) developed a pastry board made of wooden material. This board can be used for mixing, kneading and for rolling of the dough on the surface of the board. The board is made of three wooden base parts. Where the center base part is sturdy and the other two parts of wood base is present on the either side of the centre base body with the help of hinges. The board has metallic top surface flanged and lipped edges. The metallic surface acts as the non stick feature and makes the dough roll easily into a flat bread. The procedure for making roti is the side part of wood which will be overlapped on top of the central wooden part, where the dough is placed and been pressed. The pressure was provided on the side wooden board when overlapped on the central base part to press and roll the dough evenly. In this process, the dough gets rolled into an even thickness easily without any wastage of material, less time consumption and there will be no necessity of a rolling pin. This is easy to carry, portable, packed, the hanger provision is also been provided.

Fritz (1905) disclosed a rolling board, which make the dough rolled in uniform thickness with a smooth texture. In this rolling board development process, two plates are been provided with the connection of the screw-nuts, grooves, dowel pins and bolt holes, along with the bifurcated supporting plates. When rolling the dough into a ball, the dough is been placed at the center and the bifurcated plates get screwed with the dowel pins which were provided on the four corners of the base board. The screws get tightened on the four sides to the base board and accordingly the dough will be pressed and rolled

Caswell (1921) developed a rolling board which can be used for multipurpose functioning. The board comprises of a rectangular plate with an appropriate sheet metal. The rectangular plate of the metal sheet has the beading continuously across the edges of the rolling board giving stiffness to the board and which also avoids the damage or any injury to the user by this formation. At one end of the board, an overhanging portion was provided which helps the user avoiding the wastage of material and maintenance of clothes would also be neat while performing the task as the waste material can be moved aside to the overhanging portion. At the other end, the hook was provided where after completing the task the board can be hung on the wall, the rolling pin can be placed in the overhanging portion of the board. There was also a provision of grater on the overhanging portion, where the grated material comes into contact with the dough, which is a drawback of the board.

Sjoberg (1999) enclosed a rolling board which reduces the sticky nature of the dough to the board by reducing the gluten strands which formed by the heat produced during the rolling of dough. The board was frozen provided with a coolant material within, which reduces the heat formation when rolling. It was also revealed that a freezable coolant material can also be used in rolling pin which freezes the pin and reduces the heat arising while rolling activity. Accordingly, the thermal insulating mat was provided beneath the board to provide a firm grip avoiding the slipping and falling of rolling board preventing injuries to the user.

Adler (2003) developed a rolling board which is in rectangular shape provided with an elevated railing system. This system is provided in the one side of the board. The system was provided at the raised lip around the perimeter of the rolling board. When the dough has to be rolled the rolling pin provided in the traddle of the perimeter helps in rolling the dough easily and flattens into an even thickness on the rolling board.

Tool Designing Considerations

The tools which are ergonomically designed help the user in prevention of the injuries, increases the productivity and efficiency of the tools. User satisfaction will be more for these products, as well as good quality products will be produced. In order to reduce the carpal tunnel syndrome and physiological, psychological stress of the user there is a need to develop the hand tools by considering the ergonomic aspects. The hand tools have to be modified considering the science of ergonomics. The appropriate tools are the tools which were developed according to the anthropometry of the user. Accordingly, the tools developed with standards which is universal, it is not possible that the tool is perfect to all groups of people.

Greenberg and Chaffin (1997) suggested the following criteria for designing a hand tool-

Tool Weight

The tools should be easy to carry and easily portable. The tool should be in such a way that, it can be carried close to the body, can be carried with a single hand, can be lifted easily to the ceiling and can be hung to any of the wall fixture

easily.

Tool Size

- The size of the tool should be comfortable to hold, comfortable to perform activity, should be easy to move close to the body and ease the user in lifting and lowering.
- Handles or tool parts to be grasped should have a diameter of between 2-31/2 inches (strive toward the lower limit).

Tool Shape

The center of gravity of the tool should be aligned with the center of the grasping hand so that the hand will not have to overcome rotational moments or torques of the tool. For greatest comfort of use and least stress, design handles and grasping surfaces oriented so that the hand forearm are aligned. A handle to grasped should be of such shape that the forces are distributed over as large an area on the palm as possible. If surface undulations are used on tool handles to prevent hand slippage they should be highly rounded and shallow to prevent their restricting blood flow and /or creating pressure points in the palm and fingers.

Surface Color and Texture

- The surfaces of the tools should not be highly polished. Gloss paints should be avoided.
- The grip and grasping surfaces should not tend to slip from the users hand.
- Using color coding to identify different functions of tools parts, and as indicators of relative hazard of a part or work area

Edges and Corners

- Sharp edges and sharp corners to be avoided. Instead round shapes and corners are suggested.
- Wherever edges are to be grasped a high degree of rounding with a radius of at least $1/8^{th}$inch , but preferable $1/4^{th}$ inch to $3/8^{th}$ inch should be provided

Protrusions

- Surfaces to be grasped should be free of protrusions
- Whenever handles and cranks are used, by self-retracting whenever possible. So that they will not constitute protrusion hazards.

Frequency of Exertion

Exertions should be made as infrequently as possible. The greater the weight lifted or force applied, the less frequently it should be necessary to perform this task. The required grasping forces should be reduced to the minimum possible when frequent grasping is necessary.

CONCLUSIONS

From the review it can be concluded that the tools which will be designed by considering the ergonomical considerations always follow the anatomy of the user hand and posture and develop accordingly. There is a very much complexity in the human hand's shape and also the movement. The hand is the very much important organ of the human which makes the body enable to hold the tool firmly and perform the activity in different ways. Such different limits may be his/her anthropometric, physiological, biomechanical and psychological aspects, which must be considered for a safe and effective tool design. For the design of hand tools important ergonomic considerations have to be kept in mind, focusing on a consideration of how the design of the product fits the capabilities of the hands so that the comfort, ease and safety of the product are maximized and performance is enhanced. To evaluate the degree to which the design of existing products should be ergonomic, the criteria developed by many researchers can be used. These criteria can also be used to assist in the development of new tools to ensure that the requirements for ergonomic tools are met.

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